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MILITARY SPECIFICATION

CLOTH, SATEEN, COTTON, FLAME RETARDANT TREATED

This specification is approved for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Scope. This document covers one type of carded sateen cloth which has been treated for flame retardancy.

* 1.2 Classification. The cloth shall be of the following classes as specified (see 6.2).

Class 1	-	Natural or tinted
Class 2	-	Dyed, water repellent
Class 3	-	Dyed, 10.5 oz/yd^2
Class 4	-	Bleached, water repellent
Class 5	-	Dyed, 8.5 oz/yd^2

2. APPLICABLE DOCUMENTS

2.1 Government documents.

2.1.1 Specifications, standards, and handbooks. The following specifications, standards, and handbooks form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of these documents shall be those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and supplement thereto, cited in the solicitation.

Beneficial comments (recommendations, additions, deletions) and any pertinent data which may be of use in improving this document should be addressed to: U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014 by using the self-addressed Standardization Document Improvement Proposal (DD Form 1426) appearing at the end of this document or by letter.

AMSC N/A FSC 8305

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THIS DOCUMENT CONTAINS 16 PAGES.

SPECIFICATIONS

FEDERAL

V-T-276 - Thread, Cotton
PPP-P-1134 - Packaging of Cotton and Cotton-Synthetic Fiber Blend Fabrics (Excluding Duck Fabrics)

STANDARDS

FEDERAL

FED-STD-4 - Glossary of Fabric Imperfections
FED-STD-191 - Textile Test Methods

MILITARY

MIL-STD-105 - Sampling Procedures and Tables for Inspection by Attributes

(Copies of specifications, standards, and handbooks required by contractors in connection with specific acquisition functions should be obtained from the contracting activity or as directed by the contracting activity.)

2.1.2 Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this specification to the extent specified herein. Unless otherwise specified, the issues shall be those in effect on the date of the solicitation.

Rules and Regulations Under the Textile Fiber Products Identification Act

(Copies may be obtained from the Federal Trade Commission, Washington, DC 20508-0001.)

2.2 Other publications. The following documents form a part of this specification to the extent specified herein. Unless otherwise specified, the issues of the documents which are DOD adopted shall be those listed in the issue of the DODISS specified in the solicitation. Unless otherwise specified, the issues of documents not listed in the DODISS shall be the issues of the nongovernment documents which are current on the date of the solicitation.

AMERICAN ASSOCIATION OF TEXTILE CHEMISTS AND COLORISTS (AATCC)

Chromatic Transference Scale

(Copies should be obtained from the American Association of Textile Chemists and Colorists, P.O. Box 12215, Research Triangle Park, NC 27709-2215.)

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

D 1424 - Tear Resistance of Woven Fabrics by Falling Pendulum (Elmendorf) Apparatus

(Copies should be obtained from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187.)

(Nongovernment standards and other publications are normally available from the organizations which prepare or which distribute the documents. These documents also may be available in or through libraries or other informational services.)

2.3 Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification shall take precedence. Nothing in this specification, however, shall supersede applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS

3.1 Standard sample. The cloth shall match the standard sample for shade (see 3.6.1 for class 1) and appearance and shall be equal to or better than the standard sample with respect to all characteristics for which the standard sample is referenced (see 6.3).

3.2 First article. When specified in the contract or purchase order, a sample shall be subjected to first article inspection (see 4.3, 6.2, and 6.4).

3.3 Material.

3.3.1 Yarn. Warp and filling shall be singles yarn spun from carded and drawn cotton.

* 3.4 Weave. The weave shall be a 5-harness sateen. The weave for classes 1, 2, 3, and 4 cloth when viewed from the filling-effect side shall appear as shown in figure 1. The filling-effect side shall be finished and identified as the "face" side (see 3.14). The weave for class 5 cloth when viewed from the warp-effect side shall be as shown in figure 2. For class 5 only, the warp-effect side shall be finished and identified as the "face" side (see 3.14).

* 3.5 Preparation. Class 1 cloth shall be singed and desized. Classes 2, 3, 4, and 5 cloth shall be singed, desized, and mercerized.

3.5.1 Nonfibrous material. Prior to treatment, the cloth shall show no more than 3.0 percent starch and protein content including chloroform-soluble and water-soluble material, when tested as specified in 4.4.3.

3.6 Color.

3.6.1 Class 1. The color of class 1 cloth shall be natural, or may be a neutral gray tint if chemicals utilized in the flame retardant treatment impart color to the finished cloth.

3.6.1.1 Fastness to crocking. The finished class 1 cloth shall show no more crocking than an AATCC Chromatic Transference Scale rating of 1.5 when tested as specified in 4.4.3.

* 3.6.2 Classes 2, 3 and 5. Unless otherwise specified (see 6.2), the color of classes 2 and 3 cloth shall be Olive Green 107 and class 5 shall be Olive Green shade 3454 to match the standard sample. The use of dyes and compounds containing elementary sulfur capable of oxidation to sulfuric acid is prohibited. The dyestuff shall be chosen and applied so that the dyed and finished cloth shall contain no more labile sulfur than that shown by the standard sample when tested as specified in 4.4.3. When a standard sample is not available, the dyed and finished cloth shall show no more than a slight trace of labile sulfur as defined in the test method specified in 4.4.3.

3.6.3 Class 4. The color of class 4 cloth shall be white to match the standard sample. Prior to the application of flame retardant treatment, the cloth shall be bleached and may be supplemented by use of optical brighteners. The degree of whiteness shall be that imparted by the finish and shall be equal to or better than the standard sample when tested as specified in 4.4.3. When no standard sample is available, the discoloration shall be not less than "fair" when tested as specified in 4.4.3.

* 3.6.4 Matching. The color of the finished cloth for classes 2, 3, 4, and 5 shall match the standard sample when viewed under filtered tungsten lamps that approximate artificial daylight and that have a correlated color temperature of 7500 ± 200K, with illumination of 100 ± 20 foot candles and shall be a good match to the standard sample under incandescent lamplight at 2300 ± 200K.

* 3.6.5 Colorfastness. The finished cloth for classes 2, 3, and 5 shall show fastness to light, laundering (after 3 cycles), and perspiration equal to or better than the standard sample or equal to or better than a rating of "good." The finished cloth for classes 2, 3, and 5 shall show fastness to crocking equal to or better than the standard sample or shall have an AATCC Chromatic Transference Scale rating of not lower than 1.5. Testing shall be as specified in 4.4.3.

* 3.7 Physical requirements. The finished cloths shall conform to the requirements specified in table I when tested as specified in 4.4.1.

TABLE I. Physical requirements

Weight in oz per sq yd	Yarns per inch (minimum)		Breaking strength (minimum)		Tearing strength (minimum)		Stiffness (maximum)		Air permeability (minimum)
	Warp	Filling	Warp	Filling	Warp	Filling	Warp	Filling	
Classes 1-4			lb	lb	lb	lb	inch lb	inch lb	$ft^3/min/ft^2$
10.5 (max)	80	48	110	100	6.0	6.0	.0030	.0030	10.0
Class 5									
8.5 ± 0.5	86	48	115	70	8.0	6.0	.0030	.0030	10.0

3.7.1 Width. The width of the finished cloth shall be as specified (see 6.2). The minimum acceptable width shall be inclusive of the selvage when fly-shuttle looms or shuttleless with a tuck-in selvage are used. For all other shuttleless looms, the width measurement shall be made between the last warp yarn on each side excluding the protruding fringe(s).

* 3.8 Flame retardant treatment. The cloth shall be given an approved flame retardant treatment (see 6.5). Classes 1, 2, 3, and 4 finished cloth shall have an average time of after-flame of not more than 2.0 seconds, and shall be not more than 40 percent consumed both initially and after 15 launderings. Class 5 finished cloth shall have an average time of after-glow of not more than 5.0 seconds, after-flame of not more than 2.0 seconds and the char length shall not be more than 5.0 inches both initially and after 15 launderings. Testing shall be as specified in 4.4.3.

3.8.1 Absorbency of cloth - class 1. The class 1 cloth shall show a dynamic absorption value of not less than 40 percent when tested as specified in 4.4.3.

3.9 pH. The pH value of the water extract of the finished cloth shall be no less than 5.0 nor more than 8.5 when tested as specified in 4.4.3.

* 3.10 Shrinkage. The classes 1, 2, 3, and 4 finished cloth shall shrink not more than 2.0 percent and the class 5 finished cloth not more than 3.0 percent, in either direction of the warp or of the filling when tested as specified in 4.4.3. If a preshrinking process is used, it shall not be identified by name or trademark on cloth, ticket, or package.

3.11 Water-repellent treatment - classes 2 and 4. The classes 2 and 4 cloth shall be treated with an approved durable type water-repellent (see 6.5) or a non-durable water-repellent treatment (see 6.5.1). The non-durable

water-repellent product shall be applied either in a form of an aqueous emulsion or in the form of a water free solvent solution. The finished cloth shall have a dynamic absorption value of not more than 25 percent, and spray ratings of the three individual determinations of not less than 90, 90, 80, when tested as specified in 4.4.3.

3.12 Seam efficiency. The seam efficiency of the finished cloth shall be not less than 80 percent when tested as specified in 4.4.3.

3.13 Length and put-up. Unless otherwise specified (see 6.2), the cloth shall be furnished in continuous lengths, each not less than 40 yards. Each length shall be put-up in a roll as specified in 5.1.1.

3.14 Face identification. The filling-effect side of the finished cloth for classes 1, 2, 3, and 4 shall be identified as the face by stamping the word "Face" on that side at each end of the piece. For class 5 only, the warp-effect side of the finished cloth shall be identified as the face by stamping the word "Face" on that side at each end of the piece.

3.15 Fiber identification. Each piece shall be labeled or ticketed for fiber content in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act.

3.16 Workmanship. The finished cloth shall conform to the quality established by this document. The demerit points per 100 square yards when calculated as specified in section 4 shall not exceed the established maximum point values.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or purchase order, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in this document where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

* 4.1.1 Responsibility for compliance. All items must meet all requirements of sections 3 and 5. The inspection set forth in this document shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirement in the document shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in quality conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Certificates of compliance. When certificates of compliance are submitted, the Government reserves the right to inspect such items to determine the validity of the certification.

4.2 Classification of inspections. The inspection requirements specified herein are classified as follows:

a. First article inspection (see 4.3).
b. Quality conformance inspection (see 4.4).

4.3 First article inspection. When a first article is required (see 6.2), it shall be examined for appearance, color, and finish defects and shall be tested for characteristics specified in table II. The presence of any defect shall be cause for rejection of the first article.

4.4 Quality conformance inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with MIL-STD-105.

4.4.1 Component and material inspection. In accordance with 4.1, components and materials shall be inspected in accordance with all the requirements of referenced documents unless otherwise excluded, amended, modified, or qualified in this document or applicable purchase document.

4.4.2 End item examination.

4.4.2.1 Yard-by-yard examination. Each roll in the sample shall be examined on the face side only. When the total yardage in the roll does not exceed 100 yards, the entire yardage in the roll shall be examined. When the total yardage in the roll exceeds 100 yards, only 100 yards shall be examined. All defects, as defined in Section I of FED-STD-4, which are clearly noticeable at normal inspection distance (3 feet) shall be scored and assigned demerit points as listed in 4.4.2.1.1, except that only those slubs and knots which exceed the limits shown on Sears Fabric Defect Scale (see 6.7), "G" for slubs and "R" for knots shall be scored. No linear yard (increments of 1 yard on the measuring device of the inspection machine) from any one roll within the sample shall be penalized more than 4 points. The sample size shall be 20 rolls selected from 20 containers. The lot shall be unacceptable if the points per 100 square yards of the total yardage examined exceeds the following values:

35 points for class 1 cloth
30 points for classes 2, 3, and 5 cloth
32 points for class 4 cloth

The lot shall be unacceptable if the points per 100 square yards of two or more individual rolls exceeds the following point values.

53 points for class 1 cloth
45 points for classes 2, 3, and 5 cloth
48 points for class 4 cloth

If one roll exceeds the point level, a second sample of 20 rolls shall be examined only for individual roll quality. The lot shall be unacceptable if one or more rolls in the second sample exceeds the applicable point level. Point computation for lot quality and individual roll quality shall be as follows:

$$\frac{\text{Total points scored in the sample} \times 3600}{\text{Contracted width of cloth (inches)} \times \text{total yards inspected}} = \text{Points per 100 square yards}$$

4.4.2.1.1 Demerit points. Demerit points shall be assigned as follows:

For defects 3 inches or less in any dimension	- one point
For defects exceeding 3 inches but not exceeding 6 inches in any dimension	- two points
For defects exceeding 6 inches but not exceeding 9 inches in any dimension	- three points
For defects exceeding 9 inches in any dimension	- four points

NOTE: The following defects, when present, shall be scored four points for each yard in which they occur.

Baggy, ridgy, or wavy cloth
Objectionable odor
Width less than specified
Streaky or mottled color

4.4.2.2 Examination for length.

4.4.2.2.1 Individual pieces. During the yard-by-yard examination, each piece in the sample shall be examined for length. Any length found to be less than the minimum specified or more than two yards less than the length marked on the ticket shall be considered a defect with respect to length. The lot shall be unacceptable if two or more pieces in the sample are defective in respect to length.

4.4.2.2.2 Total yardage in sample. The lot shall be unacceptable if the total of the actual lengths of pieces in the sample is less than the total of the lengths marked on the tickets.

4.4.2.3 Examination for shade (classes 2, 3, 4, and 5). During the yard-by-yard examination, each piece in the sample shall be examined for shade and finish appearance. Any piece in the sample off shade, shaded side to side, side to center, or end to end shall be cause for rejection of the entire lot represented by the sample.

4.4.2.4 Examination for face identification, non-identification of preshrinking process, and compliance with Textile Fiber Products Identification Act. During the yard-by-yard examination, each piece in the sample shall be examined for defects listed below. The lot shall be unacceptable if two or more of the following defects are present in the sample:

Face identification missing from either or both ends
Face identification on wrong side
Preshrinkage process identified by name or trademark on cloth or ticket
Not labeled or ticketed in accordance with the Rules and Regulations Under the Textile Fiber Products Identification Act

* 4.4.3 End item testing. The methods of testing specified in FED-STD-191, wherever applicable, and as listed in table II shall be followed. The physical and chemical values specified in section 3 apply to the results of the determinations made on a sample unit for test purposes as specified in the applicable test method. The sample unit shall be 5 continuous yards, full width of the finished cloth and 1/4 yard prepared cloth before treatment. The sample size (number of sample units) shall be as shown below. The lot size shall be expressed in units of 1 yard. The lot shall be unacceptable if one or more sample units fail to meet any test requirement specified. All test reports shall contain the individual values utilized in expressing the final results.

Lot size (yards)	Sample size (sample units)
800 or less	2
801 up to and including 22,000	3
22,001 and over	5

TABLE II. End item tests

Characteristic	Requirement paragraph	Test method
Weave	3.4	Visual 1/
Identification of mercerization, classes 2, 3, 4, and 5	3.5	Microscopic examination for swelling of cotton fiber 1/

TABLE II. End item tests (cont'd)

Characteristic	Requirement paragraph	Test method
Singeing	3.5	2/
Nonfibrous material	3.5.1	2611
Crocking:		
Class 1	3.6.1.1	5651 3/
Classes 2, 3, and 5	3.6.5	5651 4/
Presence of labile sulfur, classes 2, 3, and 5	3.6.2	2020
Discoloration, class 4	3.6.3	5660 1/ 5/
Colorfastness to:		
Light	3.6.5	5660
Laundering (after 3 cycles)	3.6.5	3610 6/ 7/
Perspiration	3.6.5	5680
Weight	3.7	5041
Yarns per inch	3.7	5050
Breaking strength	3.7	5100
Tearing strength	3.7	ASTM D 1424
Stiffness	3.7	5202 8/
Air permeability	3.7	5450
Flame retardancy:		
Initial:		
Class 1-4		
After-flame time, seconds	3.8	5905.1
Percent consumed	3.8	5905.1
Class 5		
After-glow time, seconds	3.8	5903
After-flame time, seconds	3.8	5903
Char length, inches	3.8	5903

TABLE II. End item tests (cont'd)

Characteristic	Requirement paragraph	Test method
Flame retardancy: (cont'd)		
After 15 launderings:		
Class 1-4		
After-flame time, seconds	3.8	5556 and 5905.1
Percent consumed	3.8	5556 and 5905.1
Class 5		
After-glow time, seconds	3.8	5556 and 5903
After-flame time, seconds	3.8	5556 and 5903
Char length, inches	3.8	5556 and 5903
Dynamic absorption:		
Class 1	3.8.1	5500
Classes 2 and 4	3.11	5500
pH	3.9	2811
Shrinkage	3.10	5530
Spray rating, classes 2 and 4	3.11	5526
Seam efficiency	3.12	5110 9/

1/ One determination for each sample unit and the result reported as "pass" or "fail."

2/ Unless otherwise specified, a certificate of compliance shall be submitted and will be acceptable for the stated requirement.

3/ Class 1 cloth shall be tested against blue crock cloth.

4/ Classes 2, 3, and 5 cloth shall be tested against white crock cloth.

5/ Method 5660 shall be used, except that exposure of the specimen and standard sample shall be for 20 standard fading hours. Any specimen showing discoloration less than or equal to that of the standard sample shall be rated "pass." Any specimen showing discoloration greater than

that of the standard sample shall be rated "fail." When no standard sample is available, the discoloration shall be considered satisfactory if it is not worse than the rating of "fair" in the scale indicated in Method 5660.

6/ The specimens must be dried after each of the 3 laundering cycles.

7/ On the color transfer cloth evaluating, only the stain on the cotton fiber of the transfer cloth shall be evaluated.

8/ Method 5202 shall be followed except that an angle of 20 degrees shall be used in lieu of 60 degrees.

9/ The thread shall conform to type IA1 of V-T-276. The needle size shall be 0.049 ± 0.001 inch, and the top (needle) thread shall be ticket No. 24, 3 ply, and the bottom (looper) thread shall be ticket No. 60, 3 ply.

4.4.4 Packaging inspection. The inspection shall be in accordance with the quality assurance provisions of PPP-P-1134.

5. PACKAGING

5.1 Preservation. Packaging shall be level A or Commercial, as specified (see 6.2).

5.1.1 Level A or Commerical. The cloth shall be put-up and packaged in accordance with the applicable requirements of PPP-P-1134.

5.2 Packing. Packing shall be level A, B, or Commercial, as specified (see 6.2).

5.2.1 Levels A, B, and C packing. The cloth shall be packed in accordance with the applicable requirements of PPP-P-1134.

5.3 Marking. In addition to any special marking required by the contract or purchase order, shipments shall be marked in accordance with the applicable requirements of PPP-P-1134.

6. NOTES

* 6.1 Intended use. The cloths are for the following uses:

Class 1 - Tent liners and coveralls for explosives handlers
Class 2 - Coats and trousers for firemen
Class 3 - Flame resistant work clothing
Class 4 - Chief officers' firemen's coats
Class 5 - Haversack for storing chemical protective clothing

6.2 Ordering data. Acquisition documents should specify the following:

a. Title, number, and date of this document.
b. Class of cloth required (see 1.2).
c. When a first article is required (see 3.2, 4.3 and 6.4).
d. Color of classes 2 and 3 cloth if other than Olive Green 107 (see 3.6.2).
e. Width of cloth required (see 3.7.1).
f. Minimum piece length if other than specified (see 3.13).
g. Selection of applicable levels of put-up, preservation, and packing (see 5.1 and 5.2).

6.3 Standard sample. For access to samples, address the contracting activity issuing the invitation for bids.

6.4 First article. When a first article is required, it shall be inspected and approved under the appropriate provisions of FAR 52.209. The first article should be a preproduction sample. The contracting officer should specify the appropriate type of first article and the number of units to be furnished. The contracting officer should include specific instructions in all acquisition instruments regarding arrangements for selection, inspection, and approval of the first article.

6.5 Chemical treatment approval and testing. Approval of flame retardant treatments (see 3.8) and durable water repellents (see 3.11) for use under this document is the responsibility of the U.S. Army Natick Research, Development, and Engineering Center, Natick, MA 01760-5014, and is based on extensive tests including those for toxicity, which are not set forth in this document. To be approved, the finished cloth shall meet the flame retardancy requirements including durability to laundering after exposure to 150 kilojoules of accelerated weathering using the Xenon Arc Weatherometer. The Xenon weathering conditions may be obtained by contacting the Natick Research, Development, and Engineering Center. As a part of the approval testing of new flame retardant finishes or fiber for tentage use, the finished cloth shall have a maximum of 2.0 seconds after-flame and shall not melt or drop flaming pieces when tested in accordance with Method 5905.1 of FED-STD-191. Because of the time necessary to conduct full evaluation (approximately 6 months), only those treatments already approved and so listed in the invitation for bids or request for proposal shall be considered acceptable for related acquisition. Information pertaining to approval of new treatments should be obtained from the U.S. Army Natick Research, Development, and Engineering Center. The list of approved treatments may be obtained from the contracting activity.

6.5.1 Non-durable water repellent. Non-durable type water repellents (see 3.12) consisting of aluminum salts of saturated carboxylic acids (such as formate, acetate, palmitate or stearate), zirconium salts of such saturate carboxylic acids, or combination of both, mixed with refined mineral and vegetable waxes, titanate esters, or a combination of both, have been approved by the Surgeon General.

6.6 Dyestuff formulation.

6.6.1 Olive Green 107. A suggested but not mandatory dyestuff formulation for Olive Green 107 is as follows:

New Color Index

Vat Black 25, CI 69525
Vat Green 3, CI 69500
Vat Green 8, CI 71050

Shaded with either or both of the following:

Vat Brown 3, CI 69015
Vat Yellow of suitable fastness

The redness of shade should result from the predominant use of the main colors specified and not from the shading colors.

6.6.2 Greige construction. The greige cloth construction for this document is generally the same as the greige cloth construction for the two classes of MIL-C-10296, Cloth, Sateen, Cotton.

6.7 Fabric defect scales. Fabric Defect Replica Kits are available from Sears, Roebuck and Company, Department 817 (ATTN: BSC 23-29), Sears Tower, Chicago, IL 60684.

* 6.8 Subject term (key word) listing.

Cloth, sateen
Coats
Coveralls
Flame resistant treated
Haversack
Tent liners

6.9 Changes from previous issue. The margins of this document are marked with an asterisk (*) to indicate where changes (additions, modifications, corrections, deletions) from the previous issue were made. This was done as a convenience only, and the Government assumes no liability whatsoever for any inaccuracies in these notations. Bidders and contractors are cautioned to evaluate the requirements of this document based on the entire content, as written, irrespective of the marginal notations and relationship to the last previous issue.

Custodians:

Army - GL
Navy - NU
Air Force - 99

Review activities:

Army - MD
Air Force - 11, 82
DLA - CT

User activities:

Army - ME
Navy - OS
Air Force - 45

Preparing activity:

Army - GL

Project No. 8305-0223

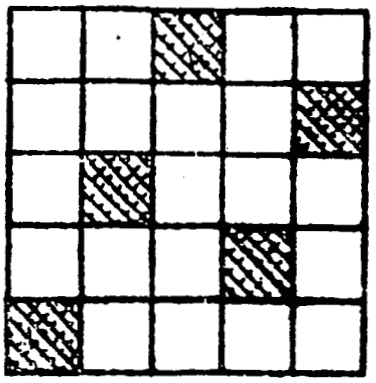

FIGURE 1. Weave pattern - filling effect.

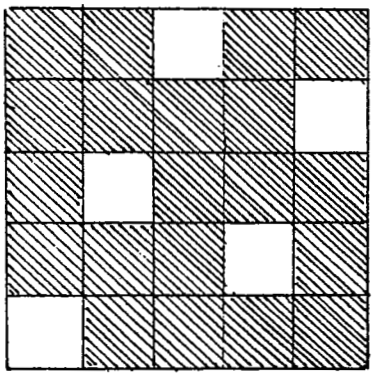

FIGURE 2. Weave pattern - warp effect.